simpson

OPERATOR'S MANUAL

SIMPSON HE 94, HE 95, HE 96 AC/DC AMP-CLAMPS

WARNING

READ AND UNDERSTAND THIS MANUAL BEFORE USING THE INSTRUMENT.

Failure to understand and comply with the WARNINGS and operating instructions can result in serious or fatal injuries and/or property damage.

DIGITAL INSTRUMENT
Warranty

SIMPSON ELECTRIC COMPANY warrants each digital instrument manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any digital instrument which shall within one (1) year after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any digital instrument which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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OPERATOR'S MANUAL

SIMPSON HE 94, HE 95, HE 96 AC/DC AMP-CLAMPS

NOTE: This Operator's Manual contains information essential to the operation of these Instruments. Therefore, it should be kept with the Instruments for reference as required.

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TABLE OF CONTENTS

SECTION I

Introduction 1-1
1.1 General 1-1
1.2 Description 1-2
1.3 Items and Accessories 1-2
1.4 Technical Data 1-3
1.5 Internal Batteries 1-5
1.6 Safety Considerations 1-5

SECTION II

Preparation for Use 2-1
2.1 General 2-1
2.2 Unpacking and Inspection 2-1
2.3 Warranty 2-1
2.4 Shipping 2-2

SECTION III

Controls, Connectors and Indicator 3-1
3.1 General 3-1

SECTION IV

Operation 4-1
4.1 General 4-1
4.2 Safety Precautions 4-1
4.3 Polarity 4-3
4.4 Measurement of Unknown Currents 4-3
4.5 Measurement of Surge Currents 4-5
4.6 Analog Output 4-6
4.7 Measurement Theory 4-7

SECTION V

Operator Maintenance 5-1
5.1 General 5-1
5.2 Battery Replacement 5-1
5.3 Care 5-1
5.4 Cord Plug Assembly 5-4

LIST OF TABLES

1-1 Items and Accessories Furnished with Each Amp-Clamp 1-2
1-2 Additional Accessories 1-3
1-3 Technical Data 1-3
3-1 Controls, Connectors and Indicator 3-1

LIST OF ILLUSTRATIONS

1-1 Simpson HE 94, HE 95, HE 96 AC/DC Amp-Clamps vi
3-1 Controls, Connectors and Indicator 3-2
3-2 Straight Female Cord Plug (Accessory) 3-3
4-1 Hall Effect 4-7
5-1 Battery Replacement 5-2
5-2 Cord Plug Assembly 5-5
5-3 Schematic Diagram 5-6
5-4 Schematic Diagram 5-7
5-5 Schematic Diagram 5-8

SAFETY SYMBOLS

The following Safety Symbols are now common and are defined here for the benefit (and education) of instrument users who may not be familiar with them or their meaning.

This symbol adjacent to a terminal, operating device, or other marking, indicates that the operator must refer to the operating instructions for further information or instructions to avoid damage to the equipment and/or to avoid personal injury.

This symbol identifies a PROTECTIVE GROUNDING TERMINAL, which must be connected to earth ground by the operator or installer prior to making any other connections or applying power to the equipment, for personal protection from electrical shock.

This symbol identifies a terminal which is internally grounded by the equipment earth grounding system and which is intended to be connected by the installer or operator to grounded or groundable circuit points for functional reasons. **Such terminals are not to be used for protective grounding purposes.**

This symbol, adjacent to a terminal or in the terminal area, is used to call attention to terminals where an especially dangerous voltage may exist; the terminal(s) and connecting leads must not be handled while energized. The symbol identifies terminals to which or from which a voltage equal to or greater than 1000 volts may be applied or supplied.

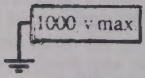
SAFETY SYMBOLS

WARNING

This WARNING sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly performed or adhered to, could result in personal injury.

CAUTION

This CAUTION sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly adhered to could result in damage to or destruction of part or all of the Instrument.



This marking advises the user that the terminal(s) so marked must not be connected to a circuit point at which the voltage, with respect to earth ground, exceeds (in this case) 1000 volts.

WARNING

This Instrument is designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurements. Failure to follow directions can result in a serious or fatal accident.

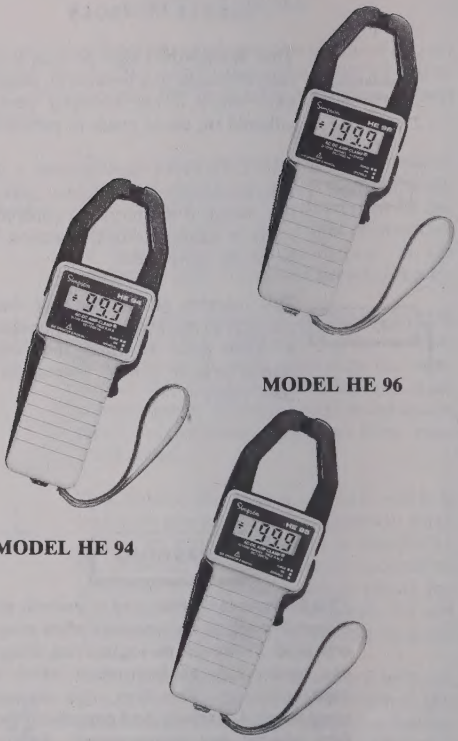


Figure 1-1. Simpson HE 94, HE 95, HE 96 AC/DC Amp-Clamps

SECTION I

INTRODUCTION

1.1 GENERAL

1.1.1 The Simpson HE 94, HE 95 and HE 96 Amp-Clamps (hereafter referred to as the Amp-Clamps or by each individual model number) are digital readout devices and are described herein along with the pertinent facts which distinguish each of them from the other.

1.1.2 The use of advance Hall Effect Technology has produced a method of measuring current from DC to 1 kHz and up to 1000 amperes. This technology has been the basis for producing three hand-held portable instruments, one measuring up to 100 amperes, the other two measuring up to 1000 amperes. Measurements, with these instruments, are made without the need to break the circuit or disturb the insulation of the conductors.

1.1.3 With the Model HE 94 and Model HE 95, measurements can be made to an accuracy of ±1% of range and indicate true rms values, even when a complex waveform is superimposed on DC (e.g., in electronically rectified current). The Model HE 96 measures average current readings from 0-1000 amperes average with the same accuracy. Additional features are the provision of analog output signals representing instantaneous and rms current, and a surge current reading facility giving a digital indication of the maximum rms current excursion in the circuit under test.

1.1.4 Accuracy of the Amp-Clamps is minimally affected by the position of the conductor within the jaws, the proximity of the return current conductor, or by stray magnetic field from adjacent components.

1.1.5 The Amp-Clamps have an advanced 3-1/2 digit Liquid Crystal Display which is made to autorange. In the Model HE 94 a resolution of 0.01 amperes is possible in the 19.99 amperes range and 0.1 amperes with 100

amperes range. In the two ranges of the Models HE 95 and HE 96, a resolution of 0.1 amperes is obtained in the 199.9 amperes range and 1 ampere in the 1000 amperes range.

1.1.6 Unlike conventional clip-on ammeters, these Amp-Clamps are a truly universal tool which will handle all current measurement jobs embracing variable speed drives, motor vehicle circuitry, battery powered equipment, welding equipment and electroplating.

1.2 DESCRIPTION

1.2.1 The individual Amp-Clamp models are functionally the same but minor design changes were made to provide a range of instruments for the industry. The Model HE 94 is true rms responding which can measure AC/DC currents in the 0-100 amperes range. The Model HE 95 is 0-1000 amperes true rms responding which can measure AC/DC currents in the 0-1000 amperes range. The Model HE 96 is 0-1000 amperes average responding with a current range of 0-1000 amperes. The detailed specifications for each Amp-Clamp are listed in Table 1-3.

1.3 ITEMS AND ACCESSORIES

1.3.1 All applicable items and accessories required or used with these Amp-Clamps are furnished with each model and are listed in Table 1-1. Additional accessories are listed in Table 1-2.

Table 1-1. Items and Accessories Furnished With Each Amp-Clamp

Quantity	Description	Number
1	3 Wire Analog Output Connector	6-113574
1*	9 Volt Alkaline Cell, NEDA 1604A	5-114907
1	Operator's Manual	6-113654

*Readily available through local retail stores.

Table 1-2. Additional Accessories

Description	Number
Deluxe Leather-Textured Vinyl Carrying Case	02232
Oscilloscope Cable — 3 Wire Plug to BNC Connector, 4′ Shielded	02057
Chart Recorder Cable — 3 Wire Plug to Spade Lug Connectors, 4′ Shielded	02058
Line Splitter, Model 151-2	00544

1.4 TECHNICAL DATA

1.4.1 Table 1-3 lists the Technical Data for the Amp-Clamps.

Table 1-3. Technical Data

Model	HE 94	HE 95	HE 96
1. Ranges:	0-100 A autoranging, 2 ranges (0-20, 0-100)	0-1000 A autoranging, 2 ranges (0-200, 0-1000)	
2. Accuracy:	±1% of range, DC 10-1000 Hz (23° ± 1°C)		
3. Resolution:	0.01 A (20 A range)	0.1 A (200 A range)	
4. Frequency Range:	10 Hz through 1000 Hz		
5. AC Response:	True rms		True average
6. Crest Factor:	6 for stated accuracy*		N/A

*AC peak value must not exceed full range value

7. Surge (maximum rms/average value):
Hold Time: indefinite (until released)
Accuracy: ±2% of range
Response time: 100 milliseconds

8. **Display Hold:** Normal readings "held" for 6-10 seconds (typical)
9. **Jaw Opening (maximum conductor size):** Up to 1-7/8″ (48 mm) diameter or 7/8″ x 2-1/4″ (22 mm x 60 mm) rectangular conductor
10. **Analog Output:** Two analog outputs are provided via a 3-wire connector, corresponding to instantaneous and rms current values
    Voltage (open circuit): 10 mV/ampere (HE 94), 1 mV/ampere (HE 95, HE 96)
    Accuracy: ±1% of high range plus ±2% offset
    Source Impedance: 50 ohms
    Maximum Load: Up to 1 mA
11. **Overload Capability:** 1000%
12. **Battery Type:** Single 9 V alkaline, NEDA 1604A
13. **Battery Life:** Typical use: 1 year. Continuous operation: 30 hours
14. **Display Type:** 3-1/2 digit, LCD, 5/8″ (15 mm) high numerals
    Symbols: Polarity, AC, low battery, A
15. **Rated Circuit-to-Ground (Earth) Voltage:** 650 V AC rms or 900 V DC
16. **Physical:**
    Dimensions: 10 x 3-1/2 x 2-3/4″ (260 mm x 90 mm x 70 mm)
    Weight: 1.25 lbs. (585 gm)
    Case: High-impact polycarbonate
17. **Environmental:**
    Operating Temp.: 0° to +50°C (+32° to +122°F)
    Temp. Coefficient: ±0.2% per °C (±0.1% per °F)
    Storage Temp.: −40° to +80°C (−40° to +175°F)
    Humidity: 0 to 80% relative humidity

1.5 INTERNAL BATTERIES

1.5.1 The Amp-Clamps require one (1) 9 volt alkaline (NEDA 1604A) battery for operation. Replacement of the battery is indicated by a low battery warning sign ("LOW BAT") that appears in the upper left hand corner of the Amp-Clamp's display window. Battery life typically is one (1) year or 30 hours of continuous operation.

1.6 SAFETY CONSIDERATIONS

1.6.1 This Operator's Manual contains special caution and warning headings which alert the user to hazardous operating and servicing conditions. These headings appear throughout this publication, where applicable, and are defined at the front of this manual under SAFETY SYMBOLS. To ensure the safety of operating and servicing personnel and to retain the operating performance of these Amp-Clamps, these instructions must be adhered to.

SECTION II

PREPARATION FOR USE

2.1 GENERAL

2.1.1 This section contains instructions for preparing the new Amp-Clamp for use. Also included are unpacking and inspection procedures, warranty and shipping instructions.

2.2 UNPACKING AND INSPECTION

2.2.1 Examine the shipping carton for signs of damage prior to unpacking. If none exist, then unpack and inspect the Amp-Clamp and packing materials for any obvious signs of damage from mechanical shock, water leakage or other causes. Check the electrical performance as soon as possible. If there is any indication of damage, notify the carrier and supplier. Also, check that all furnished items and accessories are included (Table 1-1). Save the shipping carton and packing materials for future storing or shipping of the Amp-Clamp.

2.2.2 After unpacking the Amp-Clamp, a 9 V battery may be found in the box. A 3-wire output connector should also be included. (See Section V for instructions on how to open the battery compartment and install the battery.)

2.3 WARRANTY

2.3.1 The Simpson Electric Company warranty policy is printed on the inside front cover of this manual. Read it carefully prior to requesting any warranty repairs.

NOTE: For assistance of any kind, including help with the Amp-Clamp under warranty, contact the nearest Authorized Service Center. If it is necessary to contact

the factory directly, give full details of any difficulty and include the Amp-Clamp model number, series number and date of purchase. Shipping instructions will be mailed promptly. If an estimate of charges for non-warranty or other service work is required, a maximum charge estimate will be quoted. This charge will not be exceeded without prior approval.

2.4 SHIPPING

2.4.1 Pack the Amp-Clamp carefully and ship it prepaid and insured to the proper destination.

SECTION III

CONTROLS, CONNECTORS AND INDICATOR

3.1 GENERAL

3.1.1 This section will describe the purpose and use of the Amp-Clamps' controls and their features. Become familiar with each control and its function before using the Amp-Clamps.

3.1.2 Item numbers in Table 3-1 correspond to the identifying numbers in Figure 3-1 and Figure 3-2.

Table 3-1. Controls, Connectors and Indicator

1. Housing:
   The housing of the Amp-Clamps are made of high impact polycarbonate.
2. Jaw Actuator:
   The actuator, when squeezed, opens the Amp-Clamps' jaws as well as acting as the cover for the 9-volt battery compartment.
3. Function Switch:
   This switch selects one of the 3 modes of electrical operation of the Amp-Clamps: Surge, On and Off/Hold.
4. Display:
   A 3-1/2 digit Liquid Crystal Display (LCD) with 5/8" high characters.
5. Clamp Jaws:
   The spring-loaded jaws, clamped around a single current-carrying conductor, permit the measurement of AC/DC current.
6. Analog Output Receptacle:
   Two analog outputs are provided through a 3-wire connector.

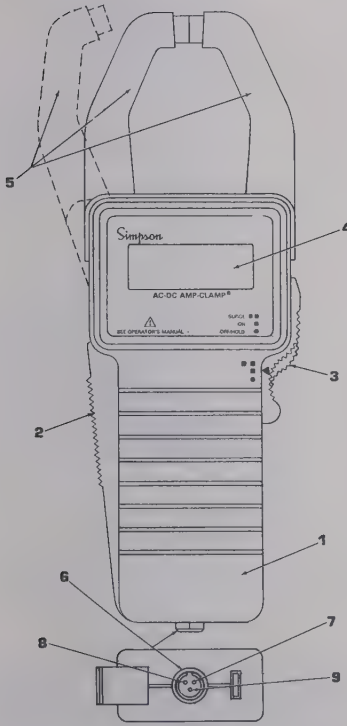


Figure 3-1. Controls, Connectors and Indicator

7. This terminal and the ground terminal provide for voltage signals to drive a recorder.

8. This terminal and the ground terminal provide for instantaneous oscilloscope voltages.

9. Ground Terminal (on the Receptacle and Accessory Plug)

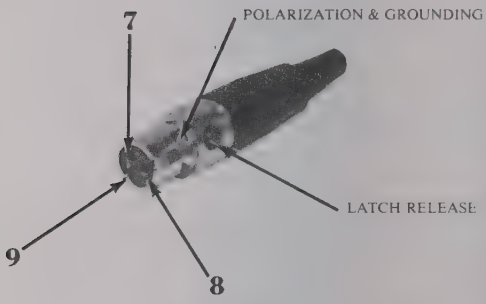


Figure 3-2. Straight Female Cord Plug (Accessory)

SECTION IV
OPERATION

WARNING

Before attempting to operate the Amp-Clamps, refer to the Warning on page v of this manual.

4.1 GENERAL

4.1.1 This section of the manual contains information required to use and operate the Models HE 94, HE 95 and HE 96 in the proper manner.

4.2 SAFETY PRECAUTIONS

NOTE: The following precautions are suggestions and reminders of commonly recognized safe practices and specific hazards to be avoided and are not implied to be sufficient to ensure the safety of untrained personnel in all circumstances. Neither is this manual a substitute for technical manuals covering the equipment in which measurements are to be made. Always refer to the equipment manual and its specific warnings and instructions and observe them as well as those contained herein.

4.2.1 These Amp-Clamps should only be used by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury.

WARNING

Industrial and commercial (480 V and 600 V) circuits in which these Instruments are likely to be used contain dangerous explosive power as well as shock hazards. Use extreme care when working in the presence of such energized circuits and keep the area clear of tools or any other conductive devices that may accidentally fall into the energized circuits. Be especially wary of uninsulated conductors or buss bars.

4.2.2 These Amp-Clamps are intended only for use indoors or in sheltered locations. To prevent fire or shock hazards, do not expose them to rain or moisture.

4.2.3 Prior to using the Amp-Clamps, check for missing, damaged, deteriorated or otherwise faulty insulating parts. Do not use, or permit the use of, any instrument with faulty insulation until it has been properly repaired.

IMPORTANT

- Always wear safety glasses and electrician-type insulated gloves when working with electrical circuitry.
- Do not work alone on high voltage circuits. Make certain that someone capable of rendering aid is nearby and watchful.

4.2.4 Hands, shoes, floor and workbench must be dry. Avoid making measurements under humid, damp or other environmental conditions that could affect the dielectric withstanding voltage of the test leads or the Amp-Clamps.

4.2.5 Do not connect any Amp-Clamp to a circuit in which the voltage, with respect to ground, exceeds the rated circuit-to-ground voltage specified in Table 1-3, Item 15.

4.2.6 The characteristics of the Hall Device are such that the environmental temperature will have an effect on the Amp-Clamp. The operator should allow the Amp-Clamp to stabilize at the operating temperature for 10 to 15 minutes. At the end of this time, the Amp-Clamp should automatically zero itself with repeated operations of the FUNCTION switch by the operator. Display will read "0.00" or "00.0" ± 1 count depending on the Model.

4.3 POLARITY

4.3.1 A polarity indication of "+" on the LCD display indicates that the current flow in the conductor is in the same direction as shown by the arrow located on the Amp-Clamp housing between the jaws. Current flowing in the conductor in the opposite direction is indicated by "–" on the LCD display. AC current is indicated by "~" on the display. Readings below 1 ampere for the HE 94 and 10 amperes for the HE 95 and HE 96 are indeterminate.

4.4 MEASUREMENT OF UNKNOWN CURRENTS

NOTE: There will be no current indication if the Amp-Clamp jaws are clamped around two conductors, such as with an AC line cord or power cord, because the opposing magnetic fields caused by each conductor will cancel each other out.

CAUTION

If possible, turn the power off to the conductor being measured before "clamping" or "unclamping" the jaws of the Amp-Clamp around the conductor.

4.4.1 The Amp-Clamp should be turned On prior to placing the jaws around a conductor. Squeeze and push the Function Switch up, toward the jaws, one notch, noting that the arrow on the Function Switch coincides with the "single square" (■) on the handle of the housing. This "single square" (■) coincides with the "On" (■) indication on the lower right hand corner of the face of the Amp-Clamp (see Figure 3-1). The display should show an "active number" change within 5 seconds as the Amp-Clamp is zeroing itself. Prior to each measurement allow the Instrument to automatically zero itself.

4.4.2 Squeeze the Jaw Actuator and encircle the conductor.

CAUTION

Do not use the Amp-Clamps on bare conductors whose ratings exceed 650 VAC rms or 900 VDC to earth ground.

Allow jaws to close completely to ensure a good contact between the closing faces of the magnetic circuit.

NOTE: The accuracy of the reading is best achieved with the conductor in the center of the opening between the surrounding jaws and the housing, or resting in the center on the top of the housing between the "arrow" and the "+" sign, or any position (up or down) between the two positions.

4.4.3 Wait for the Instrument to automatically zero itself. Apply power to the conductor.

NOTE: When measuring current with the Model HE 94 in excess of 19.99 amperes, the display will automatically change to the 0-100 ampere range and will remain in that range until the Amp-Clamp is turned off.

NOTE: When measuring current with the Models HE 95 and HE 96 in excess of 199.9 amperes, the display will automatically change to the 0-1000 ampere range and will remain in that range until the Amp-Clamp is turned off.

CAUTION

Removal of the Amp-Clamp from the conductor must be done with regard to Operator Safety. If possible, turn the power off to the conductor when "unclamping" the jaws around the conductor.

4.4.4 To hold a reading on the display, push the Function Switch down to the "Off-Hold" position (●). (See Figure 3-1.) The reading will remain on display for approximately 6 to 10 seconds before disappearing. This feature enables the Amp-Clamp to be removed from the conductor for remote viewing of the display by the operator (i.e., viewing of the Amp-Clamp in better light).

4.5 MEASUREMENT OF SURGE CURRENTS

NOTE: A feature of the Amp-Clamps is to be able to measure line-surge when equipment such as motors or generators start up on a line.

4.5.1 Turn on the Amp-Clamp as described in paragraph 4.4.1. Wait for the Instrument to automatically zero itself.

4.5.2 Squeeze and again push up the Function Switch to the second notch. Note that the arrow on the Function Switch coincides with the "double square" (■■) on the handle of the housing. This "double square" (■■) coincides with the "Surge" (■■) on the face of the Amp-Clamp.

4.5.3 Squeeze the Jaw Actuator and encircle the conductor.

CAUTION

Do not use the Amp-Clamp on bare conductors whose ratings exceed 650 VAC rms or 900 VDC to earth ground.

Allow jaws to close completely to ensure a good contact between the closing faces of the magnetic circuit.

4.5.4 Turn power on to the conductor. A reading will be automatically held on display, until Instrument is reset.

NOTE: Operation of the surge feature automatically places the Amp-Clamp in its high range of operation (0-100 amperes for the Model HE 94 and 0-1000 amperes for the Models HE 95 and HE 96) and will remain in that range until the Amp-Clamp is turned off.

NOTE: The accuracy of the Model HE 94 is not warranted below 5 amperes when in the surge mode. The accuracies of the Models HE 95 and HE 96 are not warranted below 50 amperes in the surge mode.

4.5.5 Turn power off to the conductor and remove the Amp-Clamp.

4.6 ANALOG OUTPUT

NOTE: Figure 3-1 shows the location of the Analog male output connector (Item 6). The female connector (Part Number 6-113574), supplied with each Amp-Clamp, is shown in Figure 3-2 and the assembly to a cable is illustrated and described in Figure 5-2 and paragraph 5.4. Cable make-up should be as shown in Figures 3-2 and 5-2.

4.6.1 With the cable connected between either a chart recorder or an oscilloscope and the Amp-Clamp, push the Function Switch to the On (■) position.

4.6.2 Wait for the Instrument to automatically zero itself.

4.6.3 Squeeze the Jaw Actuator and encircle the conductor.

CAUTION

Do not use the Amp-Clamps on bare conductors whose ratings exceed 650 VAC rms or 900 VDC to earth ground.

Allow the jaws to close completely to ensure a good contact between the closing faces of the magnetic circuit.

4.6.4 Turn on the power to the conductor. A current waveform will be displayed on the oscilloscope, or the rms/average current will be recorded on the chart recorder.

4.6.5 Turn power off to the conductor and remove the Amp-Clamp.

4.7 MEASUREMENT THEORY

4.7.1 The Amp-Clamps utilize Hall Effect technology which has been known to science for over 100 years. As applied, when a thin semiconductor (Hall Device) is placed transverse to a magnetic field (B) and an electrical current (I_C) is passed through the edges of the semiconductor, a voltage appears through the opposite edges. This voltage is known as the Hall Voltage (V_h) and can be used in a variety of ways.

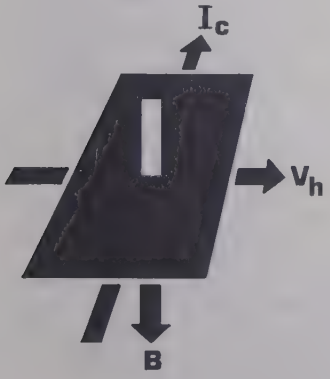


Figure 4-1. Hall Effect

4.7.2 Ampere's Law states that current flowing in a conductor produces a proportional magnetic field around the conductor. The Amp-Clamps measure the current accurately by measuring the strength of this attendant magnetic field. When the jaws of the Amp-Clamp close around a conductor, or encircle it, the magnetic field is concentrated into a magnetic circuit within which Hall Devices are placed. When drive current is applied to the Hall Devices, the resultant Hall Voltage is proportional to the product of the magnetic field and this drive current. Since the drive current is held precisely constant, the Hall Voltage is proportional to the magnetic field and hence the current flowing in the conductor.

SECTION V

OPERATOR MAINTENANCE

5.1 GENERAL

5.1.1 This section describes the procedures needed to effectively service these Amp-Clamps. Careful adherence to these routine steps will aid in the overall life of these Amp-Clamps and avoid any possible failures.

5.2 BATTERY REPLACEMENT

5.2.1 Refer to Figure 5-1 for the replacement of the single 9 V NEDA type 1604 alkaline battery.

NOTE: When the battery voltage falls within the range of 6.0 to 6.4 volts, "LOW BAT" will be indicated in the upper left hand corner of the display. Although the Amp-Clamp is still within specifications, the battery should be replaced as follows:

a. Remove the screw which secures the base of the jaw actuator lever and remove the lever.

b. Gently remove the battery from its compartment and remove the connector to the battery.

c. Attach the connector to the new battery and place it into the compartment.

d. Refit the jaw actuator lever by sliding the upper end into position so that the lower bushing aligns with its fixing hole and replace screw.

5.3 CARE

5.3.1 For insulation to remain effective it must be kept clean and dry at all times. For normal grime, use a suitable detergent and a damp cloth to clean the Amp-Clamp and dry thoroughly before use. DO NOT PERMIT LIQUIDS TO ENTER THE CASE.

Figure 5-1. Battery Replacement

5.3.2 Immediately clean all spilled materials from the Amp-Clamp and wipe dry. If the spillage is corrosive, use a suitable cleaner to neutralize the corrosive action, and remove the spillage.

5.3.3 Whenever the Amp-Clamp is not in use, return the function switch to the OFF/HOLD position.

5.3.4 Whenever possible, avoid prolonged exposure or usage in areas which are subject to temperature and humidity extremes, vibration or mechanical shock, dust or corrosive fumes, or strong electrical or electromagnetic interferences.

5.3.5 Verify Amp-Clamp accuracy by performing monthly operational checks using known, accurate, stable sources. If proper calibration equipment is not available, contact the nearest Authorized Service Center

5.3.6 It is recommended that the Amp-Clamp be returned annually to the nearest Authorized Service Center, or to the factory, for an overall check, adjustment and calibration.

5.3.7 When the Amp-Clamp is not in use, store it in a room free from temperature extremes, dust, corrosive fumes and mechanical vibration or shock. If storage time is expected to exceed 30 days, remove the battery.

WARNING

When an instrument must be stored and/or transported in a vehicle in very cold weather, it will be subject to condensation when brought into a warm building. Therefore, do not attempt measurements until certain that the instrument has had time to dry completely.

5.4 CORD PLUG ASSEMBLY

5.4.1 To assemble the cord plug to a cable, proceed as follows:

a. Strip the cable as shown in the Figure 5-2.

b. Thread stripped cable to the spacer (3), the clamp (4) and the flex relief (5).

c. Solder signal leads to the insert assembly (2). (For pin designation, see Figure 3-2.)

d. Crimp the ears on the nib of the clamp carefully around the cable insulation, being sure not to cut through it.

e. Insert the insert assembly (2), the spacer (3) and the clamp (4) into the housing (1).

f. Screw the flex relief (5) onto the threaded portion of the housing (1).

g. Check cable for proper continuity.

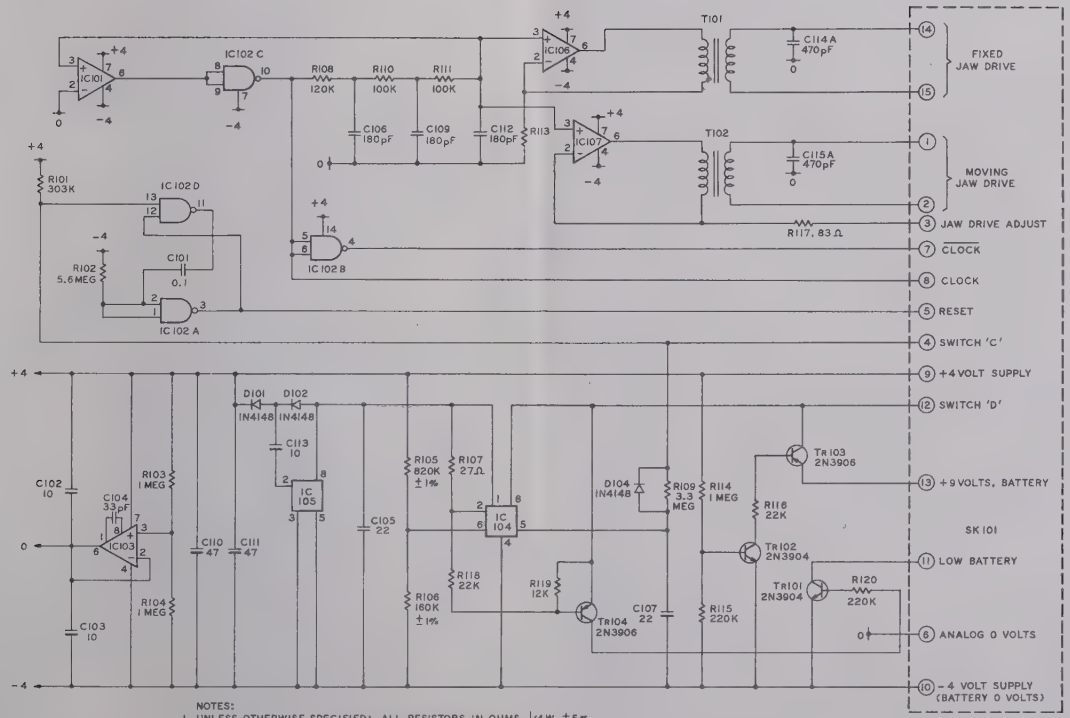
h. Insert completed cord plug assembly into the analog output receptacle (see Figure 3-1) and check the locking action of the plug.

WARNING

Do not undertake any servicing other than the instructions explained herein. All repairs and adjustments must be done by a qualified serviceman. (Refer to Section II for instructions on how to ship this instrument for repairs. The electrical schematics are included in this manual for convenience to qualified repair persons.

Figure 5-2. Cord Plug Assembly

NOTES



NOTES:
1. UNLESS OTHERWISE SPECIFIED: ALL RESISTORS IN OHMS, 1/4W, ±5%
   ALL CAPACITORS IN μF
2. VALUE OF R113 FOR MODEL: HE-94 120Ω. HE-95 270Ω.

Figure 5-3. Schematic Diagram

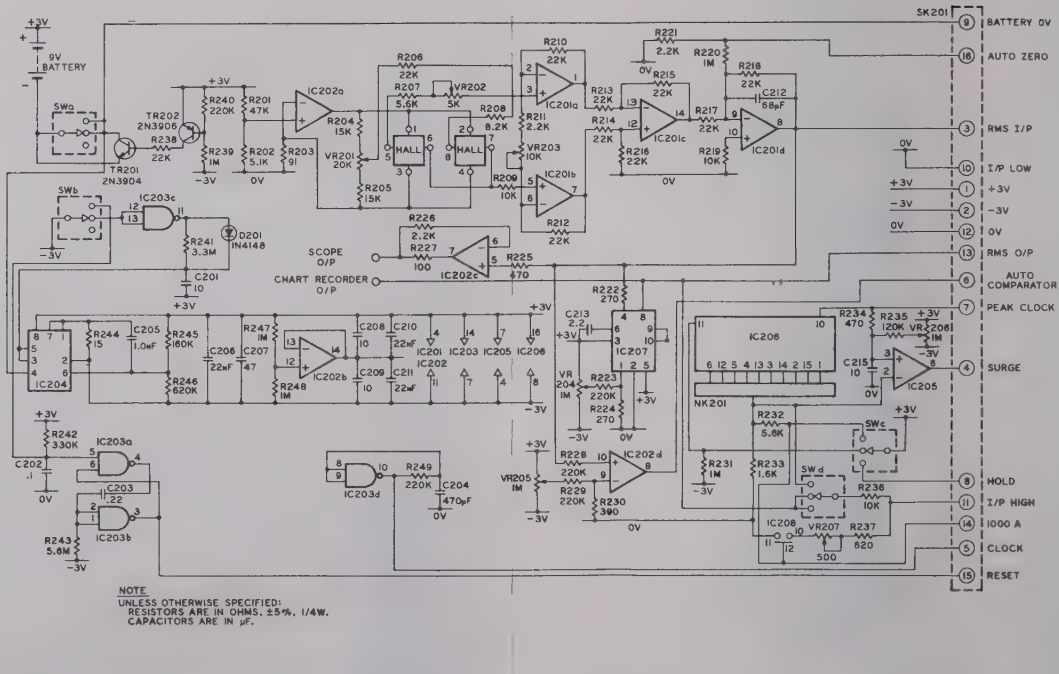


Figure 5-4. Schematic Diagram

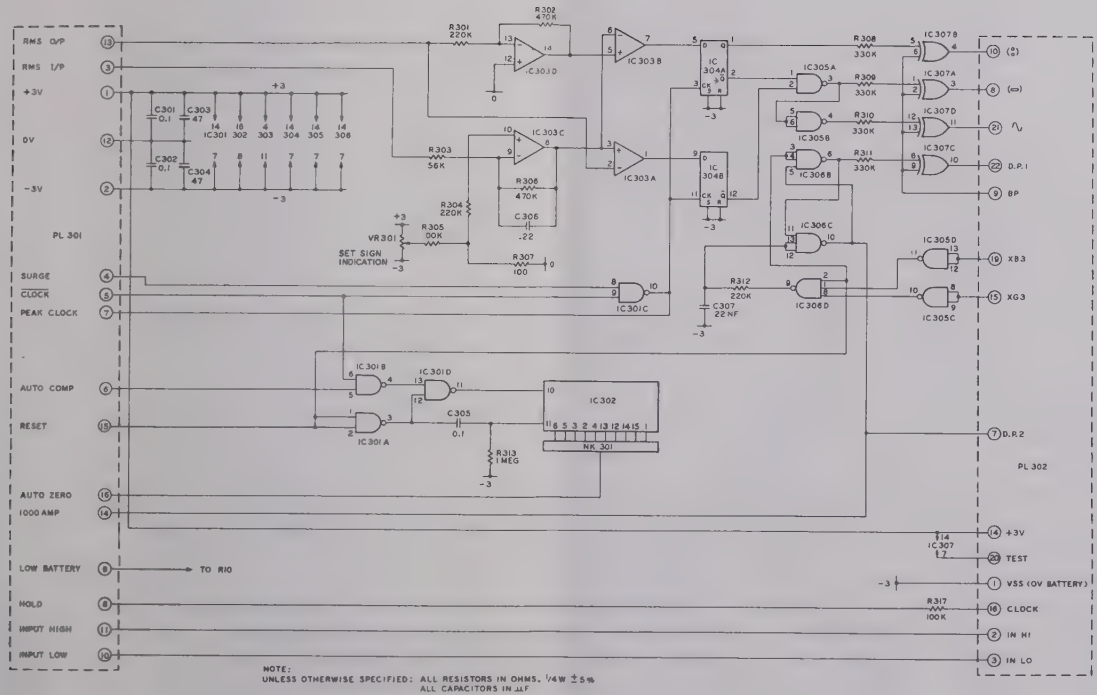


Figure 5-5. Schematic Diagram

Quality is the indispensable component of every Simpson instrument . . . . . .